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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF:	Eric BERGMAN	EXAMINER:	FRANKIE L. STINSON
APPLICATION NO.:	10/051,860	ART UNIT:	1746
FILED:	JANUARY 16, 2002	CONF. NO:	1640
FOR: **PROCESSING A WORKPIECE USING OZONE AND SONIC ENERGY**			

AMENDED APPEAL BRIEF

Mail Stop Appeal Brief -- Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Amended Appeal Brief is being filed in response to the Notification of Non-Compliant Appeal Brief mailed 10/23/2006.

A Notice of Appeal was filed on 10/31/2005. A Notice of Panel Decision from Pre-Appeal Brief Review was mailed on 12/13/2005. An Appeal Brief was filed on 01/13/2006.

[Continued on Next Page.]

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I hereby certify that this paper (along with any referred to as being attached or enclosed) is being electronically filed with the U.S. Patent and Trademark Office on the date entered below.

November 8, 2006
Date of Electronic Submission

Debbie Gilbert
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Appeal Brief Under 37 CFR § 1.192(c):

(i) Real Party in Interest.

The real part in interest is Semitool, Inc., a Montana corporation, 655 West Reserve Drive, Kalispell, Montana, 59901.

(ii) Related Appeals and Interferences.

There are no related appeals or interferences.

(iii) Status of Claims.

Claims 1, 5-10, 12-18 and 33-35 are pending and are rejected. The rejection of claims 1, 5-10, 12-18 and 33-35 is appealed.

(iv) Status of Amendments.

No amendments have been filed subsequent to the final rejection.

(v) Summary of Claimed Subject Matter.

The appealed independent claims are claims 1, 16 and 35. The content of claim 1 is generally shown in Figs. 1-3 and described at 0016-0019 and 0021-0025. Claim 1 describes an apparatus where sonic energy is used in combination with ozone to process a workpiece or semiconductor wafer. A typical use would be to strip photoresist off of a wafer after photolithography. The apparatus includes a heater which heats a liquid that is applied through outlets as a liquid layer on the wafer. The sonic energy source is associated with the outlets, with sonic energy conducted to the wafer through the liquid flowing out of the outlets. The sonic energy helps to continuously expose fresh surfaces of the photoresist (or other layer), rendering it subject to chemical attack by the ozone. This speeds up wafer processing.

Independent claim 16 is similar to claim 1. The principal differences are that claim 16 describes spray nozzles instead of the outlets in claim 1, and claim 16 further includes a rotor in a process chamber, for holding a single workpiece or wafer. Claim 16 also includes descriptions of diffusion of ozone and the sonic energy exposing fresh contamination (e.g., a photoresist layer). Unlike claim 1, claim 16 does not describe the sonic energy as conducted through the liquid. Independent claim 35 is similar to claim 1, and further includes the rotor in the process chamber.

(vi) Grounds of Rejection to be Reviewed on Appeal.

Issue No. 1: Whether claims 1, 4-10, 12-18 and 33 are unpatentable under 35 U.S.C. 103(a) over Torek *et al.* in view of Japan 1-955222, Izumi *et al.*, Miki *et al.* or Fishkin *et al.*

Issue No. 2: Whether claim 35 is unpatentable under 35 U.S.C. 103(a) over Lampert *et al.* in view of Maekawa *et al.*

(vii) Argument.

Issue No. 1. Claims 1, 4-10, 12-18 and 33 are patentable because the primary reference Torek *et al.* conflicts directly with the secondary references.

The principal reference Torek *et al.*, USP 6,758,938, describes use of a spray of liquid, see Fig. 3; col. 2, line 12; col. 4, line 35; col. 6, lines 49-65, or use of a spray lid. Col. 7, lines 14-16. No other form of liquid outlet is described. As is well known in the art, such as the secondary references listed at paragraph 2 of the 3/8/2005 Office Action, sonic energy can only travel through incompressible media, i.e., solids or continuous liquids. Sonic energy cannot travel through a spray,

because a spray is not incompressible. Rather, a spray is a stream of individual liquid droplets moving through air. Webster's Revised Unabridged Dictionary defines spray as "Water flying in small drops or particles in a stream of liquid droplets in air." In Torek *et al.*, the droplets can be seen in Fig. 3, as the water leaves the spray nozzles 75. Since Torek *et al.* only discloses spraying, Torek *et al.* teaches away from use of sonic energy, as claimed.

In addition, Torek *et al.* uses a pulsing spray process 10. Col. 4, lines 9-20, 34, 47, 58, 64; Col. 5, lines 7, 13, 23, and Col. 8, lines 26-32. This pulsing spray process is also not consistent with use of sonics. With a e.g., 20% duty cycle (Col. 5, line 11), the sonics would necessarily be inactive 80% of the time. Moreover, apart from these important conceptual differences, in the apparatus described by Torek *et al.*, there does not appear to be any reasonable way to use sonics as claimed, since the Torek *et al.* apparatus is a batch system (as opposed to the single workpiece system of claim 16).

In Fig. 3, Torek *et al.* also shows the spray nozzles 75 <u>spaced apart from the wafers</u>. This also teaches away from use of sonics, as claimed, since this spacing is not consistent with having a fluid link (see 0007) for transmitting sonic energy to the workpiece. The ozone shower system of Torek *et al.* (col. 2, line 61 et seq. and Fig. 3) also suggests spraying the edges of the wafer, rather than the wafer face. This suggestion also teaches away from use of sonic energy, as claimed.

With respect to the secondary references, Izumi *et al.*, USP 5,927,306, describes only a specific corrosion resistant ultrasonic nozzle. Miki *et al.*, USP 6,325,081 B1, describes sonic elements 604 and 605 which appear to be separate

from any liquid outlet, as claimed. See col. 14, lines 1-26. JP 01-095522 applies sonic energy through the wafer chuck, see the Abstract, and the sonic elements in this reference again are unrelated to any liquid outlet, as claimed. Miki *et al.* also tends to teach away from the use of ozone, because the Miki *et al.* process operates in a partial vacuum.

Fishkin *et al.*, USP 6,202,658, discloses a sonic nozzle used with a liquid jet. However, combining Fishkin *et al.* with Torek *et al.* conflicts with the teachings of Torek *et al.* Fishkin *et al.* relates primarily to wafer edge cleaning, and with a liquid jet set at various angles to the wafer. Fishkin *et al.* makes no suggestion of providing a liquid layer on the workpiece, as claimed, as there is no reason given for having a liquid layer at the edge of the wafer, or any mention as to how a liquid layer could be provided at the edge of the wafer.

Torek *et al.* is applied against claims 1, 4-10, 12-18 and 33 for showing all of the claimed elements, except ozone. All of the secondary references, except Miki *et al.*, disclose ultra-sonics, but not ozone. Miki *et al.* discloses both ultra-sonics and ozone dissolved in water. However, in Miki *et al.* the ultra-sonics and ozone are used separately. Fig. 8 in Miki *et al.* shows the "normal temperature washing apparatus." While the other process liquids in Fig. 8 are directed to the oscillators, the ozone water clearly is not. Fig. 9 in Miki *et al.* shows the ozone injection system, which has no ultra-sonic elements. That ultra-sonics and ozone are not used together is even clearer at col. 10, lines 10-32, which describes that ultra-sonics is applied after the use of ozonated water is halted.

The separation of sonic energy from ozone, as in Miki *et al.*, reflects conventional practice. Gases in the liquid degrade the cleaning effects of sonic energy. Specifically, the gas migrates into cavitation bubbles during their formation and prevents bubbles from imploding violently, thereby reducing the intended sonic cleaning action. The gas bubbles also absorb sonic energy (because the gas is compressible) reducing the sound intensity. For these reasons, sonic effects are degraded when used in liquids containing dissolved gases.

Correspondingly, the cleaning effects of ozone are also degraded by sonics. Specifically, sonic energy tends to cause ozone to come out of solution, reducing the ozone concentration in the liquid, and thus reducing the effectiveness of the process. For this reason, ozone and sonic energy have essentially not been used together. Accordingly, use of ozone and sonic energy would not be, and is not, obvious in the semiconductor processing field and in related fields. For these reasons, there is no suggestion in the prior art to combine any of the secondary references with Torek *et al.* Torek *et al.* teaches against such a combination.

The claimed processes avoid the drawbacks of using sonic energy and ozone gas, by providing ozone gas around the workpiece rather than dissolving the ozone gas into the liquid. The ozone gas then diffuses through the liquid layer. Thus, as described at 0007, diffusion, rather than dissolution, is the primary mechanism used to deliver ozone to the wafer surface.

Combining the teachings of the references here is based on hind-sight reasoning. Likewise, the final rejections of the claims are based on hind-sight reasoning in attempting to substitute elements from one reference into another, where no basis is present in either to suggest the substitution. As stated in C.R. Bard Inc. v. M3 systems Inc., 48 USPQ2d, 1232 (Fed. Cir. 1998), "it is insufficient that prior art shows similar components, unless it also contains some teaching, suggestion, or incentive for arriving at the claimed structure." As stated by the Court in In re Sernaker, 217 USPQ 1, 6 (Fed. Cir. 1983) in discussing an earlier case, "The lesson of this case appears to be that prior art references in combination do not make an invention obvious unless something in the prior art references would suggest the advantage to be derived from combining their teachings."

Applicant submits that, as in the C.R. Bard Inc v. M3 Systems Inc. case and in the Sernaker case, the claimed invention here is not obvious over the references . There is nothing in the references that would suggest that an improved apparatus using ozone gas and heated liquid might be achieved by combining their teachings. Nor is there anything in the references that would suggest that this improvement, i.e., an apparatus having an ozone gas supply system which provides ozone gas around the workpiece, with sonic energy provided to the workpiece through a jet of heated liquid, might be achieved by combining their teachings. The problems addressed by each of the references are different from the problems addressed by the other reference and also different from the problems addressed by the claimed invention. None of the references are concerned with providing an ozone process with sonic energy introduced to the workpiece through the liquid flow, as claimed.

The rejections of the claims appear to be the result of a failure to view the invention as a whole and each of the references as a whole. There are many cases which state the requirement that the invention must be viewed as a whole and that each of the references must also be viewed as a whole when the issue of nonobviousness is confronted. In particular, disclosures in the references that diverge from and teach away from the invention at hand cannot be disregarded, <u>W.L. Gore & Associates, Inc. v. Garlock, Inc.</u>, 220 USPQ 303, 311 (CAFC 1983). For these reasons, the rejections of claims 1, 4-10, 12-18 and 33 should be reversed.

Issue No 2.: <u>Claim 35 is patentable because Lampert *et al.* teaches away from a combination with Maekawa *et al.*</u>

Lampert *et al.*, US Patent No. 5,181,985 discloses wet chemical processes using a spray of heated water and ozone. As noted at paragraph 3 of the Final Office Action, Lampert *et al.* also suggests a chamber and a rotor, which are the two additional elements in claim 35 that are not in claim 1. However, claim 35 is patentable regardless these two additional elements. Like Torek *et al.* discussed above, Lampert *et al.* discloses a mist or spray, not the use of sonics, as there is no incompressible media in Lampert *et al.* to transmit sonics to the wafer.

Figs. 2 and 3 of Maekawa *et al.*, US Patent No. 5,868,866 disclose an ultrasonic nozzle. Ultrasonic energy is imparted to water 21 flowing out of the nozzle 20a and onto the wafer. Col. 6, lines 24-36. However, Maekawa *et al.* does not disclose use of ozone, or any other gas, for cleaning. Accordingly, Claim 35 is

patentable over the combination of Lampert *et al.* and Maekawa *et al.* for the same reasons that claim 1 is patentable over the prior art discussed above in section (vii)1.

Applicant accordingly requests that the rejections be reversed.

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Respectfully submitted,

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(viii) Claims Appendix.

1. An apparatus for processing a workpiece comprising:

a liquid supply source;

one or more liquid outlets for applying a layer of liquid onto the workpiece;

a liquid flow line extending between the liquid supply source and the one or more liquid outlets for carrying liquid to the liquid outlets;

at least one heater for heating the liquid before it is applied onto the workpiece;

an ozone gas supply system which provides ozone gas around the workpiece while the layer of heated liquid is on the workpiece; and

a sonic energy source associated with the liquid outlet, and positioned adjacent to the workpiece for introducing sonic energy to the workpiece ,with the sonic energy conducted through liquid flowing out of the liquid outlet and through the layer of liquid to the surface of the workpiece.

5. The apparatus of claim 1 wherein the sonic energy source comprises a sonic transducer including a focusing chamber for concentrating sonic energy onto the workpiece.

6. The apparatus of claim 1 where the liquid supply source comprises a liquid reservoir, and where the heater heats the liquid in the reservoir.

7. The apparatus of claim 1 where the liquid supply source includes a liquid selected from the group consisting of, ammonium hydroxide, sulfuric acid,

hydrochloric acid, hydrofluoric acid, a surfactant, de-ionized water, and a combination thereof.

8. The apparatus of claim 1 further comprising a chamber around the workpiece and with the ozone gas supply connected to the chamber to provide ozone gas around the workpiece in the chamber, with the ozone provided as a dry gas or in a liquid.

9. The apparatus of claim 8 further comprising a re-circulation liquid line extending between the chamber and the liquid supply source.

10. The apparatus of claim 8 further comprising a rotor assembly in the chamber for rotating the workpiece to provide relative movement between the sonic energy source and a workpiece held in the rotor assembly.

12. The apparatus of claim 1 further including means for controlling the thickness of a layer of the liquid formed on the surface of the workpiece.

13. The apparatus of claim 12 where the means for controlling comprises a liquid flow control system for controlling the flow of liquid onto the workpiece.

14. The apparatus of claim 13 where the liquid flow control system includes spray nozzles.

15. The apparatus of claim 12 where the means for controlling comprises a rotor for holding and rotating the workpiece.

16. An apparatus for treating the surface of a workpiece comprising:

a liquid reservoir for holding a process liquid;

a process chamber;

liquid spray nozzles within the process chamber disposed to spray liquid onto the workpiece held by the workpiece holder;

a liquid flow line extending between the liquid reservoir and the liquid spray nozzles;

a rotor in the process chamber for holding a single workpiece and rotating the workpiece to form liquid on the workpiece into a layer;

an ozone generator for generating a supply of ozone;

one or more ozone supply lines extending from the ozone generator to the process chamber, and with ozone gas in the process chamber diffusing through the layer of liquid and oxidizing contamination on the workpiece surface;

at least one heater for heating the process liquid; and

a sonic energy source associated with the liquid outlet for introducing sonic energy to the workpiece, with the sonic energy assisting to expose fresh contamination and rendering it more subject to oxidation by the ozone.

17. The apparatus of claim 16 where the workpiece support holds the workpiece in a horizontal orientation.

18. The apparatus of claim 16 further comprising a valve connecting to a spent liquid line extending from the process chamber, to the liquid reservoir, and to a drain, with the valve switchable between a first position, wherein spent liquid from the process chamber is directed back to the reservoir, and a second position, wherein spent liquid from the process chamber is directed to the drain.

33. The apparatus of claim 1 further comprising a rotor in the process chamber for holding the workpiece and rotating the workpiece at about 300 rpm or higher, to form liquid on the workpiece into a thin layer.

34. The apparatus of claim 1 with the liquid outlet applying liquid onto the workpiece in a direction substantially perpendicular to a plane of the workpiece.

35. Apparatus comprising:

a chamber;

a rotor in the chamber for holding and rotating a workpiece;

a liquid supply source;

a liquid outlet positioned to apply a liquid onto a workpiece in the chamber;

a liquid flow line connecting the liquid supply source to the liquid outlet;

a heater for heating the liquid;

an ozone gas generator;

an ozone gas supply line connecting the ozone gas generator to the chamber;

a sonic energy source associated with the liquid outlet, and positioned adjacent to the workpiece for introducing sonic energy to the workpiece, with the sonic energy conducted to the surface of the workpiece through liquid flowing out of the liquid outlet.

(ix) Evidence Appendix

None.

(x) Related Proceedings Appendix

None.